

## Organic vs. Traditional Methods

No choice is without consequences.

Most people would choose the pest control option that is cost effective, successful and didn't have unintended consequences, regardless of which camp it falls under. When comparing organic options and traditional or conventional practices, it is important to look at all the pieces to the puzzle and not just at surface titles and names. Research shows that "non-chemical" methods use a larger volume of chemicals; use more dangerous chemicals; expose more people to dangerous chemicals; have potentially greater environmental impacts; and have lower worker safety records. This article will examine some of the common chemical and mechanical control options typically used in both organic and traditional/conventional production.

Let's start with **organic chemicals**. Non-herbicidal chemicals are not benign and have their own impacts. These alternatives are often proposed without examining the total environmental impact. Many of these alternatives use more labor, energy, and fuel by requiring frequent re-treatments. These organic herbicides mimic natural plant-based chemicals, but often are still man-made chemicals. Most of the organic herbicides are non-selective. Usually, there is little or no ecotoxicity; including what these chemicals do to the soil and the beneficial flora and fauna that live in the soil. Worker exposure data usually isn't available, either. They are on the exempt list established by EPA because they mimic naturally existing compounds. The safety data sheets (SDS) for these products are thin and not very informative. Let's look at a few examples:

EcoExempt HC The main ingredients are Clove oil and phenyl propionate: Only looking at the data on the clove oil portion of this product: clove oil is a possible carcinogen; it is highly toxic to fish; causes severe eye, respiratory, and skin irritation. It is used at 10 to 30 gallons of product per acre. It is only a burn down product; meaning it doesn't provide long-term control. Which means that multiple applications would have to be made adding the greenhouse gas emissions for the equipment usage. The active ingredients may not be obtained from plants; therefore, it is still a man-made chemical. Clove oil is not registered for use in water, except for stunning or killing fish. This specific product is no longer available. However, there are other similar products on the market that rely on clove oil.

Burnout II is comprised of Citric Acid and Clove oil. The citric acid is not produced by squeezing lemons; it is a bio-chemical process utilizing sulfuric acid, calcium hydroxide, and other chemicals. There is no ecotoxicity data available.

Scythe is an organic herbicide made of pelargonic acid, which naturally occurs in many plants. The raw materials to make it in quantities needed for distribution include anhydrous butyl alcohol, sodium, ethyl malonate, heptyl bromide, potassium hydroxide, and hydrochloric acid

Acetic Acid (Vinegar): Agricultural vinegar is 20% acid. Therefore, it can easily cause eye injuries such as burns and permanent corneal injury. It can be a skin irritant or cause allergic reactions. There are also digestive tract reactions or damage, and respiratory tract irritation.

The use of **Traditional herbicides** is a regular part of open space, range, pasture, roadside and farming practices/management. Over the decades testing of these materials has been refined and the efficacy, along with the environmental protection has increased. These products have undergone extensive testing to determine LD 50 (lethal dose to kill 50% of the population), toxicology rates for a variety of species, flammability, and safety precautions. Specific details on the products can be found on the SDS sheets as well as the labels. Motorized equipment (trucks, tractors, ATV/UTV's, etc.) are still used in the application of these products. However, it is typically only one or two treatments a year versus the multiple treatments required with organic chemicals. The difficulty of addressing the creeping perennial weeds like Canada thistle and field bindweed, make selective herbicide treatments the most effective option to reduce these infestations. Annual grasses like cheatgrass that

responds to fires and out-competes our native grasses is also best addressed with herbicide treatments that allow the natives to fill back in. Our native pollinators, birds, and other wildlife prefer native species for their habitat and food sources.

**Milestone** is a selective herbicide that only affects certain broadleaf species while not impacting grasses, and many forbs and trees. It's LD50 is >5000 mg/kg. It is practically non-toxic to birds. The LC50 (Lethal Concentration) for earthworms is >10,000 mg/kg. There is acute and chronic toxicity to aquatic life hence it is not used in water. It has a negative rating for germ cell mutagenicity, it did not cause cancer in lab animals, and does not interfere with reproduction or cause birth defects. However, repeated high dose toxicity can affect the gastrointestinal tract.

**Rejuvra's** LD 50 is >2000 mg/kg. It is not carcinogenic, mutagenic, or genotoxic. Prolonged and repeated oral exposure can affect the nervous system. It is not to be used in water because there is acute and chronic toxicity to aquatic life. It does not bioaccumulate.

**Plastic mulch and barriers** also includes polyethylene barriers and permeable plastic mats. These items are placed on the soil or over vegetation to stop weeds from germinating or kill vegetation. They are non-selective meaning they will control all vegetation. These materials allow mosquitoes to breed in rainwater puddles on the sheets and fungus or mold to form underneath. They are expensive to purchase and labor intensive to install. Life expectancy is 3-5 years. Research shows these plastics can raise soil temperatures by 50 degrees Fahrenheit or more, resulting in potentially negative effects on soil flora and fauna. It takes 1328 pounds of 6 mil polyethylene to cover one acre. This polyethylene is made from oil and natural gas products. Greenhouse gases are released in the manufacturing process. There are more than 200 degradation products released as the plastic breaks down. These include alkanes, alkenes, ketones, aldehydes, alcohols, carboxylic acid, keto-acids, dicarboxylic acids, lactones, etc. ... whose environmental impacts have not been studied.

**Sheet mulching** with newspaper and cardboard is another typical mulching practice that has some questionable impacts on the soil health. Newspaper and cardboard sheet mulches can harbor pests. Termites are found to prefer cardboard over wood chips as a food source, and rodents, such as voles, often nest underneath mulch sheets. Newspaper and cardboard sheet mulches often become dislodged by winds, especially if they are exposed. Newspaper and cardboard sheet mulches can induce anaerobic conditions if used on wet, poorly drained soils. When wet, the layers of paper are compacted, creating an impermeable barrier to water and gas exchange impacting soil flora and fauna. Newspaper and cardboard sheet mulches become hydrophobic if allowed to dry out, causing rainfall or irrigation water to sheet away rather than percolate through. This is particularly true of regions with droughty summers or well-drained soils. Lastly depending on how and where the cardboard is made, it can contain a long list of chemicals and glue compounds, both of which can leach into the soil. Newspaper and cardboard with colored ink can have toxic heavy metals that can leach into the soil as well.

**Weed burners, torches, and steamers** use a flammable chemical, usually propane, that can also explode if not handled correctly. Propane is flammable at 2.2% concentration in the air. Burning vegetation produces greenhouse gases. The smoke adds to air pollution. There is always the chance of personal injury and property damage. Burning weeds has been known to start wildfires. The heat can damage soil flora and fauna. Pounds of propane can be used per acre which is a higher use rate than herbicides. Propane contains radioactive compounds including radon, lead, polonium, and bismuth. The other active ingredients in propane are dimethylmethane, and maybe ethane, n-Butane, iso-Butane, propylene, or butylene.

**Grazing** with livestock is another option used to address unwanted plants. Grazing requires the use of fuel if the livestock are moved to different grazing areas that are not connected and for monitoring the livestock when on large pastures. Manure accumulation in dry lots must be addressed. Livestock can create compaction issues in the dry lots they are kept in when not grazing on pastures and other vegetative areas. Livestock can eat desirable

vegetation in addition to the targeted species. There is the concern for over grazing when not managed correctly. Fences are required to keep the livestock in the targeted grazing area as well as in their holding pens when not grazing. Fence management can be very labor intensive.

**Mechanical methods** are utilized by both organic and traditional operations in which tractors of various sizes and age are used to carry out mowing and plowing operations with various implements, as well as chain saws, trimmers, etc. typically utilizing fuel and lubricating oils, including hydraulic fluids. These products add to the greenhouse gases, climate change, and putting petroleum by-products into the soil and environment.

Looking specifically at gasoline the LD50 is between 533 – 13,500 mg/kg which depends on the chemicals used to make “gasoline”. There can be up to 15 different chemicals used in the mixture. These chemicals are cancer hazards, volatile, flammable, and can damage the body and internal organs. There is always the potential for environmental spills when fueling the equipment which are extremely dangerous to waterways, fish and wildlife. Diesel is less toxic than gasoline but has many of the same drawbacks. Operations deposited an average of 7 liters/hectare of minimally tested fuels and lubricants unburned thru the exhaust system of tractors and implements. Chain saw bar oils remain in the soil for up to ten years.

Battery operated units are increasing however there are still issues with battery toxicity, longevity, explosions, fires, disposal and regular charging. Lithium-ion batteries contain heavy metals that are toxic to the environment. These tools still use other fluids as well.

Mechanical methods, like mowing or tillage, cause rutting, soil erosion, destruction of animal nesting sites, and direct death to animals (eggs, reptiles, rodents, birds) caught in the path of the equipment. A *50 years of study, by Bramble and Burns in Pa. found* mowing reduces quality of wildlife habitat compared with herbicidal methods. While a Mass. study by *ECI & Tufts University* found better wildlife habitat and brush control on sprayed power lines compared to mowed power lines. At one year, no herbicide residues were found in the soil, but bar oil and hydraulic fluid residues were found in the mechanically cleared areas.

**Manual mechanical methods** including weeding with hoes, shovels and pulling. There is the potential for increased erosion, especially on slopes over flat ground. The ground disturbance also opens the site to new invasions from weeds and other pests. There is an increase in labor needs and time to accomplish a project. There is also an increase in personal injuries, which can be life altering. Fuel is still used to get to the job sites in most cases.

Organic Farming versus traditional/conventional farming practices can have a great impact on soil health. Traditional/Conventional farming typically relies on 0-3 tilling's to grow a crop, whereas an organic cropping system tends to rely on 8 to 12 tilling's. Using traditionally powered equipment is equal to using 4.8-to-7-gals diesel for organic farming vs 0-to-1.8-gals for bio-tech farming per acre. Tillage increases erosion and soil compaction. Bare tilled ground loses 12 tons soil/acre/year, whereas 93% vegetative residue cover loses 0.3 ton/acre/year.

No-Till farming needs and uses herbicides to replace the traditional tilling practices. No-Till farmland reduces the release of nitrous oxide by 57% when compared to tilling. Nitrous Oxide can stay in the atmosphere for 120 years. Nitrous Oxide has 310 times the heat trapping power of carbon dioxide. Herbicide use reduces greenhouse gas warming while farming without modern herbicides increases it this is based on tillage practices alone.

**Bottom line: All options should be measured against equally tough standards, organic and traditional. Considerations need to be made for direct worker safety, exposure to carcinogens or poisons, chronic effects, impacts to the environment, pollution noise, cost, and biological effectiveness. There is no one perfect option.**